Figures and Tables in a LaTeX Document

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The Table and Figure Environments

All tables go inside `table` environments; similarly, figures go in `figure` einvironments. This environment should contain the table or figure and associated caption.

```
\begin{table}[htbp]
  ...  stuff here  ...
\end{table}

\begin{figure}[htbp]
  ...  stuff here  ...
\end{figure}
```

The `[htbp]` controls where the table or figure is placed.

Tables and figures do not need to go where you put them in the text. LaTeX moves them around to prevent large areas of white space from appearing in your paper.

Positioning Arguments

Each letter corresponds to a place where the table or figure should go:

`b` (`Bottom`)	Place the table at the bottom of the current page.
`h` (`Here`)	Place the table at the spot where the table environment appears in the text
`p` (`Page`)	Place the table at the top of the next page.
`t` (`Top`)	Place the table at the top of the current page.

The first letter inside brackets has highest priority. In the example on the previous page, if LaTeX couldn't put the table or figure "here," it tried to put it at the top of the current page, then on the bottom of the current page, then at the top of the next page.

Defining Tables

The table itself is defined by the `tabular` environment. The syntax for this is:

```
\begin{table}[htbp]
  \begin{tabular}{column specification}
    ...  Table stuff in here  ...
  \end{tabular}
\end{table}
```

The Column Specification, Part 1

You need to tell LaTeX how many columns your table will have and what kind of columns they will be. The **`column specification`** has one letter per column. For each column, there are three possibilities:

`c`	Centered column
`r`	Right-justified column
`l`	Left-justified column

The Column Specification, Part 2: Vertical Lines

If you want a vertical line between two columns, put a vertical line (|) in the column specification between the corresponding letters.

A | appearing before any of the columns gives a line down the left edge of the table.

A | appearing after all of the columns gives a line down the right edge of the table.

Example Column Specifications

Specification:	What It Does:
`{ccc}`	Three columns, all centered, no vertical lines
`{l|r}`	Two columns, one left-justified, one right-justified, with a vertical line between them
`{|l|l|l|l|l|}`	Five columns, all left-justified, with vertical lines between each pair of columns and on right and left

Separating Cells in a Row

Table cells in a row are separated with `&`. There should be no `&` after the last cell in a row. Example one-row table:

```
\begin{table}[htbp]
\begin{tabular}{lrc}
  First Cell & Second Cell & Third Cell \\
\end{tabular}
\end{table}
```

Ending Rows

Table rows are ended with \\. There should be a \\ at the end of each row. Example two-row table:

```
\begin{table}[htbp]
\begin{tabular}{lrc}
  Row 1, Cell 1 & Row 1, Cell 2 & Row 1, Cell 3 \\
  Row 2, Cell 1 & Row 2, Cell 2 & Row 2, Cell 3 \\
\end{tabular}
\end{table}
```

Horizontal Lines Between Rows

`\hline` puts a horizontal line before or after a row.

`\hline\hline` puts two horizontal lines before or after a row.

Pop Quiz! Do you know what `\hline\hline\hline` does?

Making a Table

```
\begin{table}[htbp]
\begin{tabular}{|l||c|c|} \hline\hline
  Ice Cream Store & Location & How to Get There \\ \hline
  Toscanini's & Central Square & Just walk! \\
  Herrell's & Harvard Square & Red Line \\
   J.P. Licks & Davis Square & Red Line \\
  Ben \& Jerry's & Newbury Street & Green Line \\ \hline\hline
\end{tabular}
\end{table}
```

Gives us:

Ice Cream Store	Location	How to Get There
Toscanini's	Central Square	Just walk!
Herrell's	Harvard Square	Red Line
J.P. Licks	Davis Square	Red Line
Ben & Jerry's	Newbury Street	Green Line

Table of Tables

	A	B
Foo	1 2 3 4	2 5 9 8
Bar	1 2 3 4	31 23 16 42

```
\begin{tabular}{|c||c|c|} \hline
  %%%%%% Title row starts here
 & A & B \\ \hline\hline
  %%%%%% Row Foo starts here
  Foo &
  \begin{tabular}{c} 1 \\ 2 \\ 3 \\ 4 \\
  \end{tabular} &
  \begin{tabular}{c} 2 \\ 5 \\ 9 \\ 8 \\
  \end{tabular} \\ \hline
  %%%%%% Row Bar starts here
  Bar &
  \begin{tabular}{c} 1 \\ 2 \\ 3 \\ 4 \\
  \end{tabular} &
  \begin{tabular}{c} 31 \\ 23 \\ 16 \\ 42 \\
  \end{tabular} \\ \hline
\end{tabular}
```

Graphics file formats

Bitmap

- `.png` and `.tiff`: highest quality
- `.jpeg`: good for photos, uses little space
- `.gif`: good for line drawings, limited to 256 colors

Vector

- `.eps`: best format for LaTeX, not good for editing
- `.fig`: xfig graphics, good for editing

Viewing and editing graphics

Bitmap

- `xv`: viewing
- `gimp`: editing

Vector

- `gv`: viewing `.eps` and `.ps` files
- `xfig`: editing `.fig` files

Including a Graphic

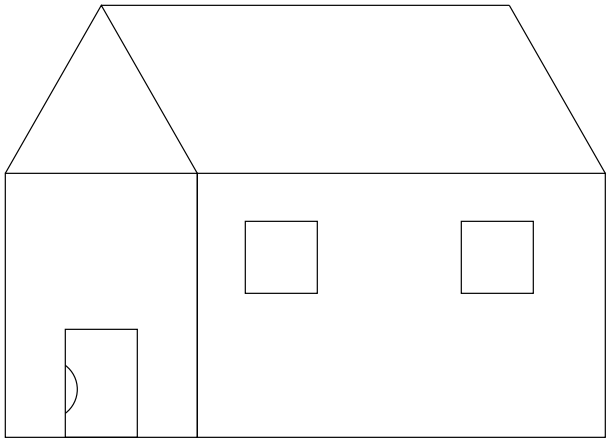
To include a graphic in your document:

```
\begin{figure}[htbp]
  \includegraphics{filename}
\end{figure}
```

Example of an Included Graphic

```
\begin{figure}[htbp]
  \includegraphics{house.eps}
\end{figure}
```

Will give you:



Scaling Graphics

Is your graphic too big? Does it ooze off into the right margin?

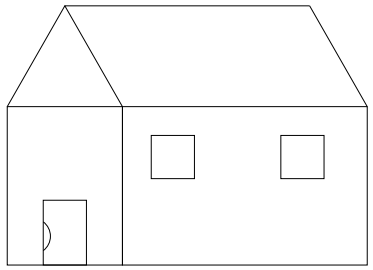
`\includegraphics` can take `scale` as an optional argument. `scale` is a number that the width and height of the figure will be multiplied by.

Usage: `\includegraphics[scale=0.7]{house.eps}`

Scaling Example

```
\begin{figure}[htbp]
  \includegraphics[scale=0.6]{house.eps}
\end{figure}
```

Will give you:



Setting Width and Height

Tired of trying to guess scale factors to get your figure to be just the right size? Use the `height` or `width` optional argument to `\includegraphics`.

Usage:

```
\includegraphics[height=2in]{house.eps}
\includegraphics[width=6cm]{house.eps}
```

A popular setting for `width` is `\textwidth`. This makes your figure be the exact width of the page. Example:

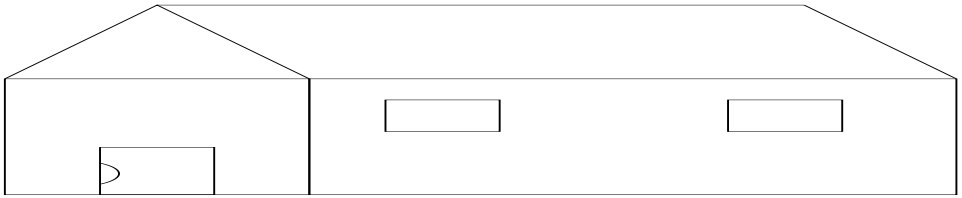
```
\includegraphics[width=\textwidth]{house.eps}
```

Distortion

There is no need to set both the width and height—the dimension you do not specify will be scaled to keep the picture's proportions correct. If you set both, you might get something like:

```
\begin{figure}[htbp]
  \includegraphics[height=1in,width=5in]{house.eps}
\end{figure}
```

Which will give you:

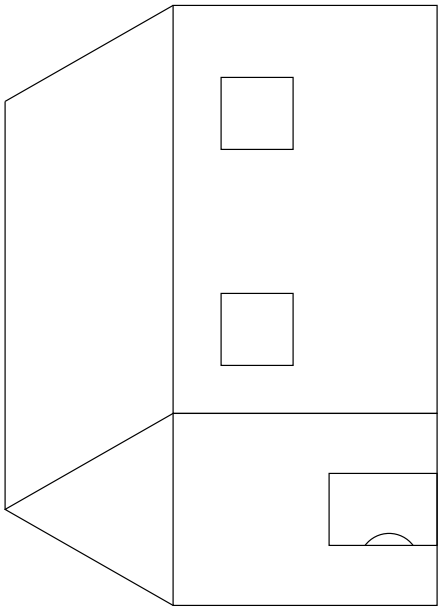


Rotating Graphics

Your graphic looks like it lay down to take a nap. Now what? Use the `angle` optional argument. The image will be rotated by a corresponding angle *counterclockwise*.

```
\begin{figure}[htbp]
  \includegraphics[angle=90]{house.eps}
\end{figure}
```

Will give you:



Centering Tables and Figures

To center a table or figure, put the `tabular` environment or `\includegraphics` command respectively inside a `center` environment. Examples:

```
\begin{table}[htbp]
  \begin{center}
    \begin{tabular}{ccc}
      Tom & Dick & Harry \\
      Mary & Cathy & Anne \\
    \end{tabular}
  \end{center}
\end{table}
```

```
\begin{figure}[htbp]
  \begin{center}
    \includegraphics{house.eps}
  \end{center}
\end{figure}
```

Captions

A figure or table without a caption feels lonely. All figures and tables should have captions. Use the `\caption` command for this purpose.

Example:

```
\begin{table}[htbp]
   \begin{center}
     \begin{tabular}{ccc}
       Tom & Dick & Harry \\
       Mary & Cathy & Anne \\
     \end{tabular}
   \end{center}
   \caption{Here are some names.}
 \end{table}
```

Caption Example

```
\begin{figure}[htbp]
  \begin{center}
    \includegraphics{house.eps}
  \end{center}
  \caption{This is a pretty little house.}
\end{figure}
```

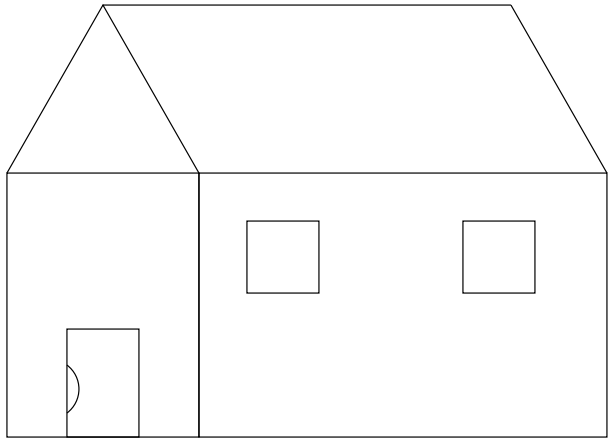


Figure 5: This is a pretty little house.

Labeling Example

A labeled table would look somewhat like this:

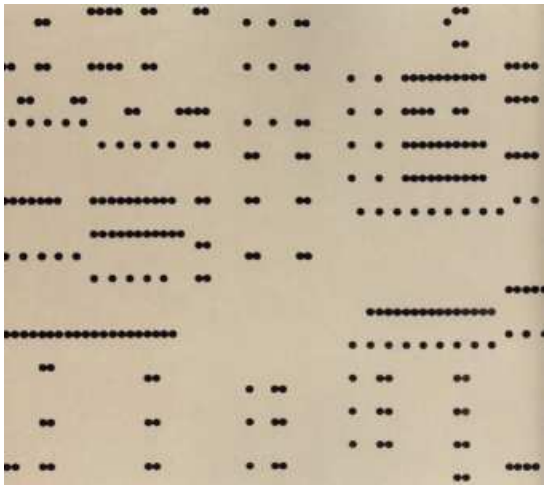
```
\begin{table}[htbp]
  \begin{center}
    \begin{tabular}{c|c|c} \hline
       Tom & Dick & Harry \\ \hline
       Mary & Catherine & Anne \\ \hline
     \end{tabular}
  \end{center}
  \caption{This is a table of common names.}\label{tbl:names}
\end{table}
```

and `\ref{tbl:names}` would give the number of that table elsewhere.

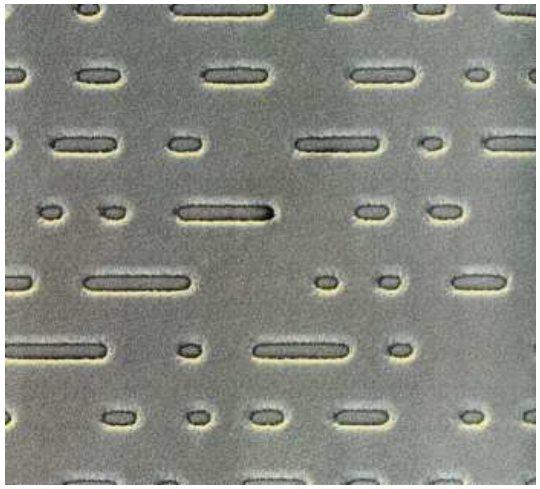
Laying out graphics using tables

```
\begin{table}[h]
\begin{tabular}{cc}
Piano player roll & Compact disc \\
\includegraphics[height=2.5in]{piano_player.eps} &
\includegraphics[height=2.5in]{CD.eps} \\
\end{tabular}
\end{table}
```

Piano player roll

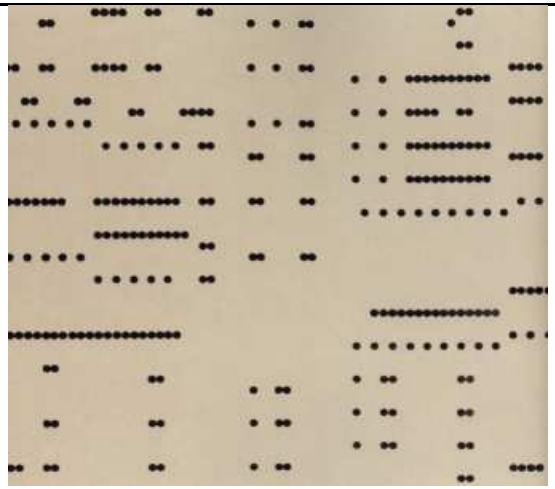
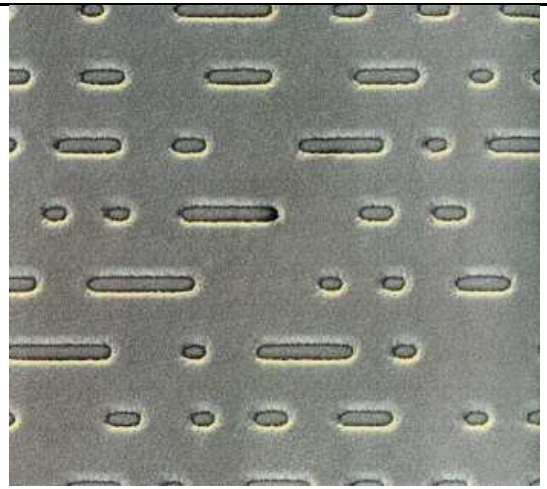


Compact disc



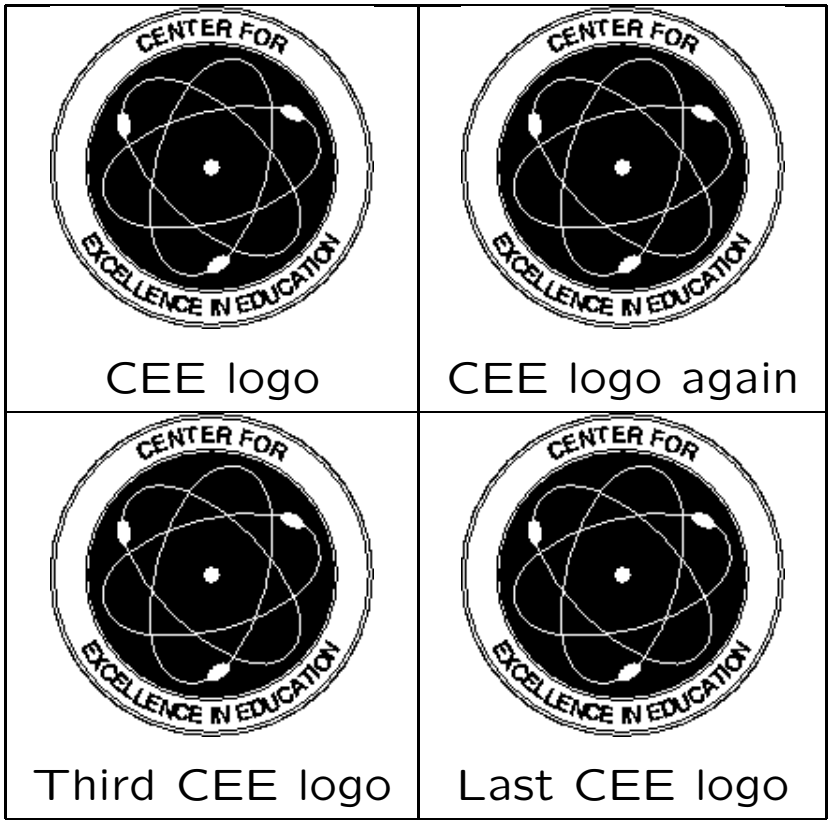
Frankel F and Whitesides GM. (1997) *On the surface of things*.

Laying out graphics using tables

Piano player roll	Compact disc
	

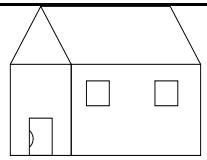
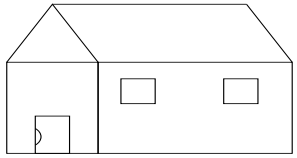
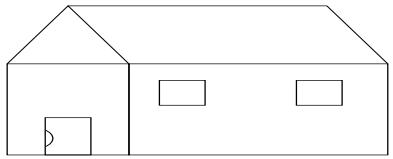
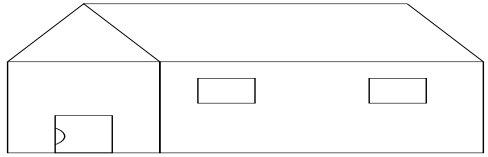
Frankel F and Whitesides GM. (1997) *On the surface of things*.

Table of Figures!



CEE logo | CEE logo again

Third CEE logo | Last CEE logo

Time	Distorted House
1 s	
2 s	
3 s	
4 s	

Common Table Errors

```
! Paragraph ended before \@array was complete.
<to be read again>
                   \par
l.11

?
```

This most likely means you forgot to end the column specification with a }.

In this case the error occurred in line 11.

Common Table Errors

```
! LaTeX Error: Illegal character in array arg.

See the LaTeX manual or LaTeX Companion for explanation.
Type  H <return>  for immediate help.
 ...

l.7 \begin{tabular}{ccf}

?
```

This means you used an invalid letter to designate a column time in the column specification. In the case shown, the culprit is the "`f`" following the two `c`'s

The error occurred in line 7 in this case.

Common Table Errors

```
! Extra alignment tab has been changed to \cr.
<recently read> \endtemplate

l.8 a & b & c &
                \\
?
```

This means that you have an extra `&` in a row. In the case that generated the error, the table is defined to have three columns, so there should be only two ampersands per row.

The extra `&` could be caused by forgetting the `\\` at the end of a row.

Common Table Errors

```
Runaway argument?
{The example table caption \end {table} \par This is the paragraph af\ETC.
! File ended while scanning use of \@xdblarg.
<inserted text>
                \par
<*> paper.tex
             \nonstopmode\input
?
```

This means that you forgot to end a table caption with a }. Notice that there is no line number listed. If you get this error, you will have to check all your captions to make sure they are OK.

Common Table Errors

```
! Misplaced \noalign.
\hline ->\noalign
                  {\ifnum 0=‘}\fi \hrule \@height \arrayrulewidth \futurelet...
l.9 d & e & f \hline

?
```

This most likely means that you forgot the \\ following the last row of the table and tried to put an \hline following it to draw a line below the table.

In this case the error is in line 9.

Common Figure Errors

```
Runaway argument?
{This is a pretty picture \end {figure} \par This is the paragraph af\ETC.
! File ended while scanning use of \@xdblarg.
<inserted text>
                \par
<*> test.tex
             \nonstopmode\input
?
```

This means that you forgot to end a figure caption with a }. Notice that there is no line number listed. If you get this error, you will have to check all your captions to make sure they are OK.